Supplement to the Application of Rivada Networks LLC for Approval as a Spectrum Access System Administrator and an Environmental Sensing Capability Operator

Submission Date: March 14, 2018

VIA ECFS

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This submission is in response to the letter from the Commission dated February 21, 2018, **Re: Proposal of Rivada Networks, LLC for Certification as a SAS Administrator; Request for Supplemental Information (GN Docket 15-319)**. Rivada makes this submission as a Supplement our original submission, per the instructions on page 4 of the letter.

1. Please provide technical details with respect to how Rivada will protect Grandfathered Wireless Broadband Licensees. GWPL's will register sites through ULS. SAS Administrators are responsible for protecting GWPLs within their protection zones. Please refer to the Public Notice released by the Commission on this topic.12 (p. 22) (§ 96.53(m))

Rivada will comply with the Commission's Public Notice on GWPL protection zones DA-16-946. As such, Rivada adopted a method for determining Grandfathered Wireless Protection Zones for existing licensees in the 3650-3700 MHz band.

In the Public Notice, the Commission established a two-prong approach for the determination of the GWPL protection zones based on whether a GWPL's base station serves unregistered, registered, or both types of CPE. In the case of unregistered CPE the sector radius will be 5.3 km from the serving registered base station. In the case of registered CPE the sector radius is that necessary to serve the most distant registered CPE unless of course that distance is less than 5.3 km whereby the first prong approach would apply.

In accordance with the Commission's Notice it is the responsibility of qualifying GWPL's to report their protection areas. As stated in DA-16-946 V.20 Implementation: "*To implement this process to determine the Grandfathered Wireless Protection Zone we will require licensees to certify which of their base stations were constructed, in service, and in full compliance with the rules by April 17, 2016. At the same time that licensees certify to the above they must identify whether or not that base station has unregistered CPE and the distance to the furthest registered CPE for each sector. Licensees will only be required to provide this information for base stations and will not be required to provide supplemental information in regard to registered CPE equipment beyond the distance to the furthest registered CPE*"

In a process yet to be defined the Commission, GWPLs will be able to update the ULS accordingly and identify the licensees Grandfathered Wireless Protection Zone. The Grandfathered Wireless Protection Zones will then be communicated to the SASs.

Using the radio planning engine, the Rivada SAS calculates the potential interference that PAL and GAA users could pose to the Grandfathered Wireless Protection Zones. The Rivada SAS sets and enforces an interference threshold that the aggregate power of co-channel CBSDs will be no greater than -80 dBm/10 MHz at any point inside the Grandfathered Wireless Protection Zone. The radio planning engine sums the contributions of co-channel CBSDs throughout the Grandfathered Wireless Protection Zone to determine if the threshold has been exceeded. This threshold test is used as a constraint in the channel/transmit power assignment algorithm described in question 4 under Incumbent Protection Constraints.

2. Please describe in detail how Rivada will protect PALs from interference caused by other PALs and from GAA users, including calculation and enforcement of PAL Protection Areas. (p. 16-17) (§ 96.53(i))

In this answer, we describe the method by which PALs are protected from interference caused by other PALs and from GAA users. This is part of the overall channel and transmit power assignment method that is described in our answer to question 4 of this document.

a. Step I – Protecting Incumbents

Rivada SAS creates PAL channel assignments using a typical frequency planning process. The first part of the process is the determination of the allowed channels for each PAL. This step protects incumbents who are already operating in the PAL spectrum. Rivada SAS creates a database table that contains a list of the PALs and a figure of merit for each PAL on its use of each channel. We use a required attenuation margin for each channel, as illustrated in Table 2.1 of the example below.

PAL Device	Pal Licenses	PAL Channels									
		0	1	2	3	4	5	6	7	8	9
CBSD001	4	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	6 dB	0 dB	0 dB	0 dB
CBSD002	4	0 dB	0 dB	9 dB	0 dB	0 dB	0 dB	3 dB	9 dB	0 dB	0 dB
CBSD003	4	0 dB	0 dB	12 dB	0 dB	0 dB	0 dB	9 dB	0 dB	0 dB	0 dB
CBSD004	3	0 dB	9 dB	0 dB	0 dB	0 dB	9 dB	12 dB	0 dB	0 dB	0 dB
CBSD005	3	0 dB	0 dB	3 dB	0 dB	0 dB	0 dB	3 dB	3 dB	0 dB	0 dB
CBSD006	2	0 dB	3 dB	9 dB	0 dB	0 dB	3 dB	6 dB	0 dB	0 dB	0 dB
CBSD007	2	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	3 dB	3 dB	0 dB	0 dB
CBSD008	2	0 dB	0 dB	6 dB	0 dB	0 dB	6 dB	3 dB	0 dB	0 dB	0 dB
CBSD009	2	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	9 dB	0 dB	0 dB	0 dB

Table 2.1: *Shows the impact of interference on the transmit power levels that will be allowed on a respective frequency at a specific CBSD cell/sector. This process comprehensively considers power controls as a means to protect PALs from interference from other PALs and GAAs.*

In Table 2.1, we can see that channels 1,2,5,6 and 7 are in use by incumbents. Many of the PALs in the area in question would be required to power down to use those channels. The power reduction values are calculated using the radio planning engine and the interference threshold for the type of incumbent.

This table also shows the number of PAL licenses acquired by the owner of each CBSD in column 2, to illustrate that license allocations are being considered concurrently in the assignment algorithm.

The PAL protection areas are calculated by the radio planning engine and include areas where the signal power is greater than or equal to -96 dBm/10MHz then limited by the boundary of the license area, using a GIS operation.

During the channel assignment phase of the algorithm, the Rivada SAS sums up the received signal strengths from co-channel CBSDs and ensures that this signal level does not exceed -80 dBm (over 10 MHz). During the same step, the SAS ensures that the adjacent channel and in-band blocking interference does not exceed the level specified in §96.41(d). The algorithm considers alternate limits on interference (if applicable) from the affected Priority Access Licensee.

Step II – Frequency Reuse Matrix

Create a reuse matrix for all PAL devices. If the PAL device is owned by the same mobile operator entity, then the reuse is allowed. If the PAL devices are not owned by the same entity, a value is used to quantify the extent to which reuse of the respective channels should be allowed. For each transmitter/receiver pair, a required attenuation value for the transmitter is calculated. This number represents the reduction in power that would be necessary if those two PALs were assigned the same channel.

Transmit \ Receive	CBSD01	CBSD02	CBSD03	CBSD04	CBSD05	CBSD06	CBSD07	CBSD08
CBSD01	0 dB	0 dB	0 dB	0 dB	0 dB	3 dB	3 dB	0 dB
CBSD02	0 dB	0 dB	0 dB	3 dB	3 dB	0 dB	6 dB	3 dB
CBSD03	0 dB	0 dB	0 dB	0 dB	3 dB	6 dB	0 dB	6 dB
CBSD04	0 dB	3 dB	0 dB	0 dB	0 dB	0 dB	3 dB	6 dB
CBSD05	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB
CBSD06	3 dB	0 dB	6 dB	3 dB	0 dB	0 dB	0 dB	0 dB
CBSD07	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB
CBSD08	0 dB	0 dB	3 dB	0 dB	0 dB	0 dB	0 dB	0 dB
CBSD09	3 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB

Table 2.2: *This matrix shows the impact of any CBSDs being assigned the same channel. In times of high user demand, CBSD pairs may be assigned less than ideal reuse, indicated by orange or red levels of interference.*

Step III – Automatic Frequency Planning

The problem of channel assignments is now resolved with an automatic frequency planning process. The algorithm creates a frequency assignment plan that will maximize the transmitted power by minimizing the attenuations required from the PALs in the network. In this way, the algorithm will reduce the assignment of PAL channels that would otherwise degrade the mobile performance due to interference.

Step IV – Assign Allowed GAA Channels

During the channel assignment phase, the algorithm will determine the allowed power (required attenuation) for each channel by each GAA CBSD. This produces a list of feasible channels for each GAA CBSD and associated transmit powers. This information is sent to the GAA CBSDs.

3. Describe the process by which Rivada will make CBSD registration information available to the general public, but obfuscate the identities of the licensees providing the information for any public disclosures. (p. 26) (§ 96.55(a)(3))

Rivada will make data available to users based on account status. In other words, PAL license holders will have access to information on the Rivada Web Based Portal consistent with the rights of their licenses. GAA applicants will access a different set of tools that address where and what type of GAA installations are permitted after taking into account Federal Incumbents, existing FSS earth stations, GWPL exclusion zones and finally PAL licensees, bands, and frequencies. The FRN and other identifying information of the PAL licensees shall be obfuscated utilizing best practices masking techniques. In accordance with such techniques Rivada will obfuscate a unique "identity" for each and every PAL grant regardless of the actual licensee so that the assigned "identity" is neither reused within the context of the complete data set of

licensees or at any other time in the future. Regardless of this masking, Rivada will at all times be able to internally, for the client, and the FCC maintain the integrity of the data for auditing purposes.

Permitted information will be made available, both visually and by download, through an online portal that can be accessed by incumbents, licensees and the general public. The class of user will dictate the type of information that will be made available to the specific user for download. To the extent possible, or required by law, specific information will be obfuscated, so as not to reveal private, sensitive or proprietary information to unapproved parties. Where appropriate, statistical information will be provided instead of more granular information that may otherwise expose privacy concerns.

a. Please explain in detail how the SAS will communicate with CBSD proxies in required information exchanges. (§ 96.57(b))

Rivada will establish an interface between our own database which incorporates a policy rule setting engine to communicate the directly with CBSD clients of the Rivada SAS and optionally multiple CBSD clients may be communicated with through a CBSD-proxy in accordance with the standards to be established in by the WInnForum in Document WINNF-16-S-0016.

Communication between the Rivada SAS and client CBSD will meet the specification in WINNF-16-S-0016 Chapter 8 in which the protocol for information exchange is detailed. However, WINNF-16-S-0016 does not define how URL's are to be assigned to CBSD and CBSD proxies. Rivada's SAS will provide URL's consistent with our SAS service to include that appropriate DNS addresses for routing to through the SAS-CBSD interface. Communications over this interface is encrypted and dependent on unique authentication factors including but not limited to CBSD MAC address, and private key exchange.

4. How will Rivada determine the available and appropriate channels/ frequencies for CBSDs at any given location? Rivada stated it would follow WinnForum but did not specify which specific standards it would follow - please include this information and proprietary solutions, if applicable. (p. 16; 23) (§§ 96.59 et seq.)

a. General Approach

Rivada uses a series of calculations and a search algorithm to find the best choices for the available and appropriate channels/ frequencies for CBSDs at any given location.

To achieve accurate and dynamic frequency channel assignments, an automated rule-based algorithm will be followed that is very similar to traditional frequency planning for mobile networks. The radio planning engine leverages a GIS-based system that stores modeled radio propagation for each CBSD and incumbent and can predict interference in the mobile environment. The reuse matrices described in the answer to question #2 above will be inputs into the channel assignment algorithms.

There will be the need for occasional manual evaluation of channel assignments, tuning of models and algorithms, and the injection of factors into the reuse matrices that compensate for inaccuracies in the underlying geo-spatial data. The resulting propagation modeling that calculates radio coverage and interference will also be calibrated with measured data to ensure reasonably accurate judgments can be made on the respective channel assignments. Otherwise, once the data required for modeling is complete and accurate, the automatic frequency planning (AFP) algorithm will take over the designation of channel assignments on an ongoing basis. There will only be occasional manual adjustments performed as new

CBSDs are introduced or when measured data indicates less than ideal performance of the algorithm, requiring optimization.

The collective GIS data, propagation models, and knowledge base feeds an iterative search algorithm that finds the best choice for assignment of channels and transmit powers to CBSDs. This rule-based algorithm is bound by hierarchal constraints or "rules" that specify which channels can be used by which tier, constraints that protect upper tier users, and other constraints described below. The algorithm ensures that the highest priority rules are always respected (such as incumbent protection levels) and the lower priority rules are respected to the extent possible (such as providing PALs with the specific channels they requested).

The channel and transmit power assignment algorithm runs, checking combinations of channels and transmit power assignments until it finds the best choice that satisfies all the given rules.

The calculations and algorithms are re-run regularly when there is a change that impacts the validity of the current channel/transmit power assignments send to CBSDs. Some examples of changes that trigger a re-run include: the addition/removal/change to CBSD; a change or expiration of an exclusion or protection zone; notification from an ESC, federal government agency, or the President of the United States.

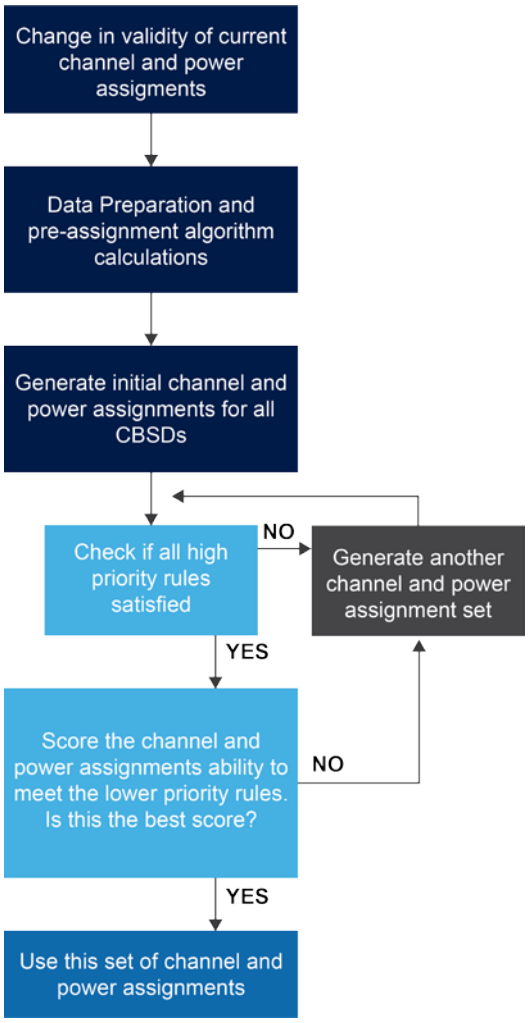


Figure 4.1: *Flowchart of the channel/transmit power assignment algorithm*

Figure 4.1 shows the steps in the approach.

b. Data Preparation and Pre-Assignment Calculations

In preparation for running the automated algorithm, Rivada SAS performs a series of checks and calculations that assure the accuracy of the decision support system that is tied directly into the AFP engine that designates the frequency channel assignments. These regularly performed checks and calculations include:

- Administrative checks (eligibility, registration) and flagging the result of those checks with the appropriate element in our database (such as a CBSD or FSS earth station). The flags inform the channel/transmit power assignment algorithm how each transmitter/receiver will be considered.
- Radio Frequency calculations using a radio planning engine (such as radio coverage, interference, or protection zone calculations). These calculations are performed by commercial off the shelf product that determines signal levels and interference levels. As input, we consider the transmitter and receiver operational parameters, including location, antenna parameters (height, radiation pattern, azimuth, tilt), transmit power, and receiver characteristics. We use a digital terrain and clutter database as an input to the coverage and interference calculations.

- Layered corrections to reuse matrices, which characterize the amount on interference potential between all transmitters and receivers in the frequency band. These correction layers may also include exclusion areas that impact specific channels for specific periods of time. They are designated as layers, so they can be appropriately modified or timed out to be included or excluded from the channel assignment analysis at prescribed intervals.
- Geographic Information System (GIS) calculations perform optimizations on protection contours such as the trimming of a PAL protection area with the license area boundary.

c. Incumbent Protection Constraints

To protect incumbents, our algorithm sets up the boundary conditions for assignment of channels and transmit powers for the PAL and GAA users, the computations include the following:

- If any alternate interference agreement exists between incumbents and lower-tier users, the corresponding interference calculations are tagged to those cases.
- Calculation of exclusion zones and protection zones is done using a combination of GIS and the radio planning engine. The start and end dates are checked to determine applicability of the zone and zone type.
- If there is a notification that would require a change or termination of usage of frequencies in a geographic area (such as notification from an ESC, President of the United States, or other federal government entity), these restrictions will be used in the subsequent run of the channel/transmit power assignment algorithm. These restrictions will remain in place until the expiration date or otherwise notified by a verifiable source.
- For the protection of FSS earth stations operating in the 3600-3700 MHz band, the channel/transmit power assignment algorithm checks each possible assignment to see if protection is sufficient. If the protection is insufficient, the algorithm continues to test other assignments until the protection criteria is met
    - To protect against co-channel, the radio planning engine sums the received power spectral densities at the earth station from all co-channel CBSDs within 150 km, using the criteria in §96.17(a)(2)
    - To protect against blocking, the radio planning engine sums the received powers at the earth station from all co-channel CBSDs within 40 km, using the criteria in §96.17(a)(3)
- For the protection of FSS earth stations operating in the 3700-4200 MHz band (flagged as TT&C), the channel/transmit power assignment algorithm checks each possible assignment to see if protection is sufficient. If the protection is insufficient, the algorithm continues to test other assignments until the protection criteria is met.
    - To protect against out of band emission into the FSS, the radio planning engine sums the received power at the FSS from all CBSDs within 40 km. This is done using the filter characteristic of the CBSD and the criteria in §96.17(b)(1)
    - To protect against blocking at the FSS, the radio planning engine sums the received power at the FSS from all CBSDs within 40 km. This is done using the filter characteristic of the CBSD and the criteria in §96.17(b)(2)
- For the protection of existing operators in the 3650-3700 MHz band, the channel/transmit power assignment algorithm checks each possible assignment to see if protection is sufficient. If the protection is insufficient, the algorithm continues to test other assignments until the protection criteria is met. This protection test is used for Grandfathered Wireless Broadband Licensees registered in the SAS and qualify for this protection based on the administrative criteria in §96.21(c)

- Using the radio planning engine, the Rivada SAS calculates the potential interference that PAL and GAA users could pose to the Grandfathered Wireless Protection Zones. The Rivada SAS sets and enforces an interference threshold that the aggregate power of co-channel CBSDs will be no greater than -80 dBm/10 MHz at any point inside the Grandfathered Wireless Protection Zone. The radio planning engine sums the contributions of co-channel CBSDs throughout the Grandfathered Wireless Protection Zone to determine if the threshold has been exceeded.

d. PAL Protection Constraints

PAL assignments will be protected as appropriate, based upon the most current valid allocations of channel slots.

- The SAS performs a GIS aggregation of geographically adjacent license areas so that it is treated as a single unit for the calculation purposes in the channel/transmit power assignment algorithm. However, the license areas remain separate for administrative tracking purposes.
- The SAS flags multiple channels held by the same licensee within the same license area. This flag invokes a rule in the channel/transmit power assignment algorithm that it should attempt to assign adjacent channels
- The SAS flags CBSDs that have requested specific channels. This flag invokes a rule in the channel/transmit power assignment algorithm that it should attempt to assign the requested channels
- The PAL protection areas are calculated by the radio planning engine to include areas where the signal power is greater than or equal to -96 dBm/10MHz and then limited by the boundary of the license area, using a GIS operation.
- The interference criteria check is calculated by the radio planning engine. It sums up the received signal strengths from co-channel CBSDs and ensures that this signal level does not exceed -80 dBm (over 10 MHz). During the same step, the SAS ensures that the adjacent channel and in-band blocking interference does not exceed the level specified in §96.41(d). The algorithm considers alternate limits on interference (if flagged as such) from the affected Priority Access Licensee.

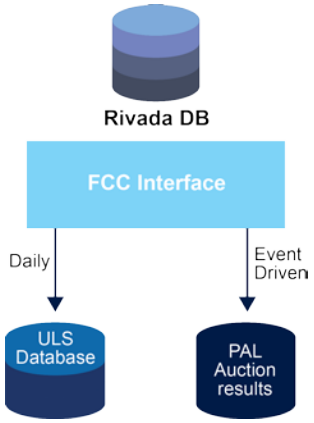
e. GAA Assignments

- The SAS will provide each authorized CBSD with frequency(ies) that do not interfere with the PAL and incumbent tier users based on the constraints specified above.

f. Standards and Proprietary Solutions

Rivada uses components from commercial off the shelf products to determine the available and appropriate channels/ frequencies for CBSDs at any given location. Some of these products contain algorithms that are proprietary. We also use custom software (proprietary) as part of the SAS software system. We are open to the possibility of using the same or similar components as other SAS administrators as part of any standardization effort.

5. Describe in detail the process by which Rivada will acquire and store the necessary and appropriate information from the Commission's databases, including PAL assignments. Further, Rivada must confirm that its database will synchronize with the current Commission databases at least once a day. (§ 96.63(b))



Rivada will download and maintain an independent copy of the complete ULS with specific emphasis placed on the Microwave - 47 CFR Parts 74 and 101, and 3650 - 3700 MHz database. Data will be stored on a secure SQL database (referred to above as the Rivada DB). The Rivada DB will query the ULS daily for any updates. In addition to this information Rivada will access the FCC PAL Auction results as the FCC makes them available.

Then in accordance with WInnForum Document WINNF-16-S-0245, Rivada will ensure that our SAS database is synchronized with the PAL Database, which is populated and maintained through cooperation between SAS Administrators, on a daily basis. Rivada will make use of the PAL Database to perform verification of PAL holder rights to the relevant license areas during the separate process for registering PAL Protection Areas (PPAs), and to make consistent channel assignments to CBSDs in the cluster list of that PPA.

Regarding protected Fixed Satellite Service (FSS) Earth Stations, the Commission (as of December 20, 2017) is in the process of developing the processes and procedures to be issued in future Public Notices.

FSS earth stations in the 3600-3700 MHz band may register for protection from Citizens Broadband Radio Service users in accordance with Part 96 of the Commission's rules. Also, FSS earth stations in the 3700-4200 MHZ band used for telemetry, tracking, and command (TT&C) operations (per §96.17(b)) may register as protected earth stations in accordance with the Commission's rules.

A database of protected FSS earth station sites will be publicly accessible after registration procedures and instructions are published and registrations are received. (To be defined by the FCC's registration process).

6. How will Rivada provide a means to make non-federal non-proprietary information available to the public in a reasonably accessible fashion? (p. 8) (§96.63(j))

Rivada will provide all non-federal non-proprietary information to the public through our portal website. We will make this data (as determined and allowed by the FCC) available to the public on the website and provide basic filtering capability to effectively search through and display the data. In addition, we will allow the public to the download the filtered/displayed data as a .CSV file.

7. What protocols will be in place to respond to instructions from the President of the United States and other Federal government entities? (p. 8) (§ 96.63(1))

Rivada will comply with the requirement to provide information to and accept instructions from the President of the United States and other authorized Federal government entities. All authorized entities will be pre-registered with Rivada including their contact information. We use a prearranged verification method to authenticate such requests.

Rivada's SAS Operations Center manages the SAS performance and operation. To log, track, and execute tasks related to SAS operation, we use an Incident Management System, commonly referred to as a trouble ticketing system. This system manages any issue related to the SAS operation, whether it be administrative, technical, or otherwise.

Upon receipt by Rivada, instructions from the President of the United States and other Federal government entities are entered into the incident management system and assigned a maximum severity level (which equates to the shortest response time). The ticket is dispatched to the appropriate individual who has the skills and authority to resolve the ticket. If the request is non-urgent in nature, the severity can be subsequently downgraded.

Any legitimate and verified request to change or terminate any frequency usage in one or more geographical areas will be implemented and remain active until further notification from the requesting entity as described in section 4 of this document under the heading titled Incumbent Protection Constraints. Such a request will be manually entered into the system and will be activated within less than 300 seconds, as required by the legislation.

All frequency changes and terminations that are initiated due to an authorized entity will be communicated to all other SASs in near real-time using the methodology described in section 2.4 SAS-SAS communication in the original Rivada submission - Rivada CBRS SAS ESC Application GN Docket No. 15-319. All such communications will strictly adhere to the WInnForum SAS-SAS Protocol Technical Specification WINNF-16-S-0096-V1.0.0.

8. What protocols will be in place to comply with enforcement instructions from the Commission? (p.8) (§ 96.63(m))

Rivada's SAS Operations Center manages the SAS performance and operation. In order to log, track, and execute tasks related to SAS operation, we use an Incident Management System, commonly referred to as a trouble ticketing system. This system manages any issue related to the SAS operation, whether it be administrative, technical, or otherwise. Upon receipt by Rivada, we enter any enforcement instructions from the Commission into the incident management system and assign the appropriate severity level, which determines the priority level of the ticket and associated response time. Tickets are dispatched to the appropriate individual who has the skills and authority to resolve the ticket.

As needed, Rivada personnel will contact the Commission point of contact to request clarification or seek assistance from the Commission. When we have completed the request, the ticket is marked as "resolved" and the original requesting person(s) are notified. The original requesting person, then can check if the Rivada response to the request is acceptable, before closing the ticket. If the Rivada response is not satisfactory, the ticket is moved back to "open" status and Rivada continues to work the ticket with the Commission until it is completed satisfactorily.

9. Please provide details regarding PAL leasing. For example, what process will be in place to:

The high-level architecture of the Rivada SAS is described in section 1.5 of the "Rivada Networks SAS Administrator and ESC Operator Application" ("Rivada Application"). The Rivada SAS includes a database which contains information on the currently active spectrum leases and information that is relevant to managing and preventing interference.

a. Verify that the lessee is on the certification list; (p. 8) (§ 96.66(a)(l))

The Rivada SAS will access the FCC Universal Licensing System (ULS) and the PAL Database to obtain information on the current certifications. The Rivada SAS extracts this information from the PAL Database based on WInnForum specification WINNF-TS-0245-V1.0.0 or most current version.

b. Acquire and store the lease notification information; (§ 96.66(a)(2))

The Rivada SAS will include a monitoring function that queries the PAL Database at least once a day. Any updates will cause the internal tables of the Rivada SAS database to update and any derivative information such as predicted interference levels will also be updated. The expiration, extension and termination information will be used to determine the exact times that that the lease modifications are applied to the downstream analysis.

c. Verify that the lease will not result in the lessee holding more than the 40 megahertz of Priority Access spectrum in a given License Area; (§ 96.66(a)(3))

If a lease will result in a lessee holding more than 40 megahertz of spectrum based on the information contained in the PAL Database, the Rivada SAS will deny the lease request. A SAS Grant Response message will be sent to the lessee using the protocol described in Section 10.6 of the of "SAS to CBSD Technical Specification" (WINNF-TS-0016-V1.2.1). If the spectrum exceeds 40 MHz the request will be denied by sending an SAS Grant Response with the Success field set to false and a disapproved message.

d. Verify that the area to be leased is within the Priority Access Licensee's Service Area and outside of the Priority Access Licensee's PAL Protection Area; and (§ 96.66(a)(4))

The lease area, Priority Access Licensee's Service Area (Service Area) and Priority Access Licensee's PAL Protection Area (Protection Area) are each represented by a polygon. The Rivada SAS' GIS engine compares the polygons to verify that the leased area polygon enclosed within the Service Area polygon and does not intersect the Protection Area polygon. The Rivada process for calculating the Protection Area is described in our response to question 4 above.

e. Provide confirmation to licensee and lessee whether the notification has been received and verified. (§ 96.66(a)(5))

A confirmation message will be sent to the licensee and lessee using the Grant Response message described in Section 8 of WINNF-15-P-0023 indicating success and the lifetime of the grant.

10. Describe in detail how Rivada will ensure that FSS operations licensed to operate in the 3600-3700 MHz band will be protected from CBSD operation consistent with part 96 rules. Please also discuss the extent of Rivada's use of WinnForum standards. Please follow the Public Notice released by the Commission on this topic. (p. 21-22) (§§ 96.17 et seq.)

In this answer, we describe the method by which FSS operations licensed to operate in the 3600-3700 MHz band will be protected from CBSD operation consistent with part 96 rules. This is part of the overall channel and transmit power assignment method that is described in our answer to question 4 of this document.

Rivada will comply with the requirements in Section 4.2 of the "Requirements for Commercial Operation in the US 3550-3700 MHz Citizens Broadband Radio Service Band" WINNF-TS-0112, Version V 1.4.1 or the most current version.

The FSS protection depends on the Grandfathered Wireless Broadband License statuses within the protection area defined for a particular grandfathered FSS earth station.

If said licenses have not yet expired, the Rivada SAS applies Incumbent Protection constraints to the channel/transmit power assignment algorithm that are consistent with 47 CFR part 90, subpart Z, including limitations on distance from the FSS earth station and station transmit power limits.

If said licenses have already expired, the Rivada SAS applies Incumbent Protection constraints to the channel/transmit power assignment algorithm that are consistent with protection criteria in §96.17.

- The Rivada SAS includes a constraint in the channel/transmit power assignment algorithm for a Cochannel criteria.

  In this case, the radio planning engine performs the geometric analysis to calculate the antenna gain using §25.209(a)(1) and 25.209(a)(4), and a reference RF filter between the feed-horn and LNA/LNB, with 0.5 dB insertion loss in the passband. The radio planning engine of the Rivada SAS sums of the power spectral density contributions of the co-channel CBSDs within 150 km of the FSS earth station under consideration. The threshold for the constraint in the used in the channel/transmit power assignment algorithm is that this sum must not exceed −129 dBm/MHz.

- The Rivada SAS includes a constraint in the channel/transmit power assignment algorithm for a blocking criteria.

  In this case, the radio planning engine performs the geometric analysis to calculate the antenna gain using §25.209(a)(1) and (4) and a reference RF filter between the feed-horn and LNA/LNB, with a filter mask of 0.6 dB/MHz attenuation to 30.5 dB at 50 MHz offset below the lower edge of the FSS earth station's authorized passband, and 0.25 dB/MHz attenuation to 55.5 dB at an offset greater than or equal to 150 MHz below the lower edge of the FSS earth station's authorized passband. The radio planning engine of the Rivada SAS sums of the emissions contributions of the co-channel CBSDs within 40 km of the FSS earth station under consideration. The threshold for the constraint in the used in the channel/transmit power assignment algorithm is that this sum must not exceed a median RMS value of −60 dBm.

To the extent that interference protection depends on antenna, filter and propagation models Rivada will continually refine and improve models to increase the accuracy of the interference models. These updates will be subject to rigorous testing and any required certification process.

11. Please affirm that the Rivada SAS will allow CBSDs to operate within areas that may cause interference to FSS earth stations, in excess of the levels described in § 96.17(a) and (b), provided that the licensee of the FSS earth station and the authorized user of the CBSD mutually agree on such operation and the terms of any such agreement are provided to Rivada. (§ 96.17(e))

Rivada affirms that the Rivada SAS will allow CBSDs to operate within areas that may cause interference to FSS earth stations, in excess of the levels described in § 96.17(a) and (b). This is provided that the licensee of the FSS earth station and the authorized user of the CBSD mutually agree on such operation, and the terms of any such agreement are provided to Rivada.